

**Fire Interdisciplinary Research on Ecosystem Services: fire and climate
change in UK moorlands and heaths (FIRES)**

SEMINAR 1

The Role of Managed Fire in Ecosystem Services of UK Moorlands and Heathlands

The University of Edinburgh, 31st March – 1st April 2008

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**Introduction: Our heaths and moorlands – values and criteria for
management**

Thank you for the invitation to introduce this Seminar. I feel it has come at a very significant time when there is much renewed interest in the future of our moorlands and heathlands, and particularly in the role of fire in their management. I am sure these Seminars will make an important contribution to the continuance of what has been a fascinating series of discussions and studies on heathland use and management and the role of fire. There is increased concern over the need to relate management to sustainability and future land uses, and this demands reassessment of the values we attach to our heaths and moors, and the means of realising them.

I would like to begin by recalling briefly some of the ways in which our heaths and moors have acquired cultural values, then to touch on how the uses they have been put to have led to programmes of research, some of far-reaching importance, and finally to comment on how the results have contributed to the quest for identifying criteria for good management.

First, we should go back for a few minutes to the period of 50 – 60 years from the start of the twentieth century, when vegetation ecology in the UK and W. Europe was just emerging from its infancy and there was much interest in the origins and dynamics of heaths and moorlands in this area. Evidence was accumulating that (apart from those of the higher altitudes) they were in the main derived from former forest or woodland.. This process began, at first temporarily and on a small scale, probably in the Neolithic period at least some 7000 years ago, proceeding from then on and expanding. There was

argument as to the causes, but it soon became accepted that although changes in climate may have played some part, the prime trigger was forest clearance due to human activity. We shall hear more of this from Althea Davies shortly, but this history was soon confirmed by the new development of pollen analysis of peat profiles, in the period following about 1940.

What also became apparent was that, on acid soils, the cleared areas were colonised by heather (*Calluna vulgaris*) and other heath species, which were already commonly present in the glades and openings of the woodland. Like the grassland areas on richer soils, heath patches provided grazing for the domestic animals of the first peoples to settle the area. At first they soon moved on and trees returned, but obviously they gained some value from this and when larger areas permitted more animals (sheep, cattle, goats, ponies) the trees were kept at bay for longer periods and the settlements became more permanent. Thus from the start heaths and moors had an important value and were managed to retain and improve this value. Heather was the main species and provided grazing of reasonable quality, available throughout the winter as well as in summer. Although a woody perennial, heather proved to be tolerant of moderate grazing (e.g. offtake of up to about 40% of production of new green shoots, per year). A further advantage was that much of this food is held high enough to be available even when there is a medium cover of snow.

This value of heaths and moors for herbivore production has of course stayed with us in W. Europe through the past 7000 years or so, though during the most recent 200 years it has declined following the intensification of agriculture and other factors. In this period the area of heathland has been much reduced – perhaps less so in N. Britain than elsewhere in W. Europe. More recently in the UK landowners of heaths and moors have benefited from a new source of value created by the increased numbers of two other herbivores which depend on heather for much of their food – namely the red grouse and red deer. With the rise in demand for sport shooting and deer stalking in the 19th and 20th centuries, this has proved an important source of income for many Estates, and management has concentrated on maintaining extensive stands of heather, usually by means of regular burning rotations.

From early days the heather plant itself has also proved of value in other ways. For example it was cut and harvested as a source of thatch for buildings, as a cheap and resilient foundation for tracks and roads, to produce dyes for fabrics, and as a fuel. It has always provided a valuable source of honey for bees. In other ways, too, heather-dominated ecosystems have had less quantifiable but also important value in their contribution to landscape quality, and more recently in respect of the conservation of significant pools of biodiversity of the fauna and flora of acidic habitats. All these values and “ecosystem services” have led to distinctive ways of life in the settlements on heathlands and the evolution of associated types of houses, tools and cultures (including songs, poetry and art).

All this has dictated a need for management because heather is not a climax dominant, and if left to itself over a period of years allows return of trees, or entry of competitor species such as worthless grasses or bracken. Management by control of grazing can delay this succession, but on its own is seldom adequate to prevent it. What becomes necessary is the periodic removal of the increasing biomass of woody heather branches, to permit regeneration and re-establishment of young stands with abundant new growth of palatable green shoots. From early days it became evident that controlled burning was a relatively easy and economical means of doing this. When properly controlled, fires effectively remove much of the above-ground biomass, and do not kill the stem bases from which vegetative regeneration can quickly produce a new, vigorous and even-aged stand of young shoots. Even if conditions do not favour this, heather generally lays down an abundant seed bank from which germination may be prolific. Therefore, prescribed burning widely became the norm.

But as systems of land use and ecology became more widely understood in the years running up to the mid 1950s, concerns arose over an apparent decline in fertility and productivity of heaths and moors, as shown by the returns from sheep or cattle farming and rents for grouse shooting.. Some conservationists were worried that regular burning was causing depletion of nutrients and loss of biodiversity. This coincided with a phase in the development of ecological science when production ecology and research on nutrient budgets and nutrient cycling in ecosystems was very much in vogue. Some of the earliest work in this field had indeed quantified losses of nutrients occurring in smoke and

leaching from ash following management fires. On the basis of a recommended frequency of burning of about once in every 10 to 15 years in some areas this could be significant.

The then Nature Conservancy (later Nature Conservancy Council and NCC Scotland) got together with other bodies such as the Forestry Commission, the Hill Farming Research Organisation, the Department of Agriculture for Scotland and the Scottish Agricultural Colleges, and others, to set up two high-powered “technical meetings” in 1955 and 1957. These assembled a galaxy of leading ecologists, agriculturalists, foresters, landowners, etc., from both Scotland and England, which included celebrities such as Professors Pearsall (University College, London), Braid (Glasgow), Wynne Edwards and Matthews (Aberdeen), Dr Fraser Darling and many others. Their task was to discuss the need for new research on the impacts of muirburn and lay the foundations for future research. They were the forerunners of a formally constituted Muirburn Committee which met four times between 1962 and 1965, and stimulated a great deal of important work. For the first time full nutrient budgets were obtained for heathland sites, including the nutrient funds in the rooting regions of the soil as well as in the various components of the vegetation, both before and at intervals after burning, and the nutrient inputs from rainfall in the periods between fires. This produced a much more balanced assessment of the impacts of burning, and a revision of the rather alarmist suggestion that management using fire was responsible for widespread damage to the fertility of our uplands. I would like to draw attention to the rather unique role of the Muirburn Committee in bringing together academic ecologists and management practitioners to agree on what research was needed and getting it done. Also in the course of addressing an important applied problem, advances of real significance to plant ecology generally were made.

Very recently it has become necessary to look at heath and moorland management in a new light. This is because of a new threat to the future of these ecosystems from the effects of nitrogen enrichment derived from rainfall polluted by industry or intensive agriculture. In certain areas, notably the Netherlands, Germany, Southern Scandinavia and SE England, this has caused extensive loss of heath communities, owing to the fact that heather is susceptible to increased competition from unwanted species of grasses such as *Molinia caerulea* and *Deschampsia flexuosa* which respond with increased vigour to the enhanced levels of available nitrogen in the soil. This emphasises the important fact that the heath and moorland communities which we value, including heather and its associates,

are adapted to acidic, rather nutrient-poor soil environments where they are at an advantage compared to calcicolous or basiphilous species.

When it comes to management, we can now recognise that one reason for the efficacy of many of the traditional forms of management (including harvesting, turbarry, plaggen, and fire) was that they had the effect of reducing the accumulation of nitrogen-rich litter, humus and biomass in the surface layers of the soil. The work of the Muirburn Committee and subsequent research has culminated in the availability of excellent guides to good muirburn practice, so it is unnecessary to repeat all their advice, except to say, in conclusion, that it is essential to gear management regimes to a clear vision of the objectives to be gained in each particular location, and to pay particular attention to the morphological age of the heather at the time of burning, in order to secure good, vigorous regeneration. Heather stands should not be too old (generally not more than about 15 - 18 years before re-burning, depending on the habitat) in order to avoid the generation of too high a temperature in the canopy. In general, it is desirable to burn relatively small patches (e.g. ½ - 1 ha), to produce a mosaic of stands of varying age.

Maintenance of the values outlined above and the current uses of most heaths and moorlands are probably sustainable if the commonly recognised criteria for good management of heather are observed. However, it needs to be emphasised in conclusion that the creation of extensive, uniform stands of over-aged heather is to be avoided. For most purposes, variety of age-structure, and diversity resulting from local variations of regime (including where appropriate a small proportion of unburnt patches), are to be preferred.